What is claimed is:

1. An imaging lidar system aboard an aircraft or a spacecraft comprising:

a light source transmitting a first beam of light ;

means for scanning both the first beam of light transmitted to surface of the ground and a second beam of light received from the surface of the ground, wherein transmission scanning of field of view of the surface is ahead of reception scanning of field of view of the surface;

means for detecting the second beam of light received from the scanning means and generating signals responsive to the light; and

a processor system for processing signals from the detecting means.

2. The imaging lidar system as in claim 1, wherein the light source includes a laser.

3. The imaging lidar system as in claim 2, wherein the laser is pumped by diode laser arrays operating in CW mode and passively Q-switched by a saturable absorber.

4. The imaging lidar system as in claim 1 further comprising:

means for angularly displacing the transmitter beam in the forward direction of the lidar system motion at the input to the scanner.

5. The imaging lidar system as in claim 4, wherein the angularly displacing means include a prism or a mirror.

6. The imaging lidar system as in claim 1, wherein the detecting means includes an array of two-dimensional pixellated detectors for detecting the second beam of light received from the scanning means and generating signals responsive to the light.

7. The imaging lidar system as in claim 6, wherein the detectors are photon detectors emitting detection signals responsive to the number of the reflected photons from the surface.

8. The imaging lidar system as in claim 7, further comprising a multi-channel timing receiver wherein the number of channels is equal to the number of pixels in the array detectors.

9. The imaging lidar system as in claim 1, wherein the scanning means includes a dual wedge scanner comprising:

a first optical wedge, with a first cone half-angle, comprising a central portion and an annular portion;

a second optical wedge, with a second cone half-angle, comprising a central portion and an annular portion;

wherein phases of the central portions of the first and the second optical wedges are advanced relative to phases of the annular portions of the first and the second optical wedges, respectively; and

means for counter-rotating the first and the second optical wedges whereby rotation of one of the optical wedges is in one

direction while rotation of the other optical wedge is in the opposite direction.

10. The imaging lidar system as in claim 9, wherein the instantaneous position of the receiver field of view on the surface at time t is determined by the following equations:

$$x(t) = v_g t + R\tan\alpha[\cos\omega t + \cos(-\omega t + \Delta\varphi)]$$
$$y(t) = R\tan\alpha[\sin\omega t + \sin(-\omega t + \Delta\varphi)]$$

wherein v_g is the ground velocity an aircraft or a spacecraft in the positive x-direction; ω is the angular velocity of the counter-rotating optical wedges; α is the cone half-angle of optical wedges; R is the perpendicular distance from the scanner to the surface; and $\Delta\varphi$ is the relative starting phase of the optical wedges.

11. The imaging lidar system as in claim 9, wherein the means for counter-rotating the first and second optical wedges comprises in combination:

a first annular bevel gear connected relative to the first optical wedge;

a second annular bevel gear connected relative to the second optical wedge;

a bevel miter gear rotatably journaled between the first annular bevel gear and the second annular bevel gear for engagement therewith;

motor means; and

means for operatively connecting said motor means to the first optical wedge, the second optical wedge or the bevel miter gear whereby rotation of one of the wedges in one direction will rotate the other of the wedges in the opposite direction.

12. The imaging lidar system as in claim 9, wherein the means for counter-rotating the first and second optical wedges comprises in combination:

a first annular bevel gear connected relative to the first optical wedge;

a second annular bevel gear connected relative to the second optical wedge;

a first motor means for rotating the first annular bevel gear;

a second motor means for rotating the second annular bevel gear;

means for driving said first motor means and said second motor means in the opposite directions at the angular velocity of ω and with a fixed phase offset $\Delta\varphi$.

13. The imaging lidar system as in claim 9, wherein the first and the second wedges are in a constant rotating motion.

14. The imaging lidar system as in claim 1, further comprising means for determining and controlling scan frequency of the scanning means.

15. The imaging lidar system as in claim 1, further comprising a telescope that transmit the first beam and receives and collimates the second light beam returned from the surface prior to the scanning means.

16. An imaging lidar system aboard an aircraft or a spacecraft comprising:

a light source transmitting a first beam of light ;

means for scanning both the first beam of light transmitted to surface of the ground and a second beam of light received from the surface of the ground, wherein transmission scanning of field of view of the surface is ahead of reception scanning of field of view of the surface;

an array of two-dimensional pixellated detectors for detecting the second beam of light received from the scanning means and generating signals responsive to the light; and

a processor system for processing signals from the detectors.

17. An imaging lidar system aboard an aircraft or a spacecraft comprising:

a light source transmitting a first beam of light ;

a optical scanner comprising:

a first optical wedge, with a first cone half-angle, comprising a central portion and an annular portion;

a second optical wedge, with a second cone half-angle, comprising a central portion and an annular portion;

wherein phases of the central portions of the first and the second optical wedges are advanced relative to phases of the annular portions of the first and the second optical wedges, respectively; and

means for counter-rotating the first and the second optical wedges whereby rotation of one of the optical wedges is in one direction while rotation of the other optical wedge is in the opposite direction and with a fixed phase offset $\Delta\varphi$; and

means for detecting the second beam of light received from the scanning means and generating signals responsive to the light; and

a processor system for processing signals from the detecting means.

18. An imaging lidar system aboard an aircraft or a spacecraft comprising:

a light source transmitting a first beam of light ;

a optical scanner comprising:

a first optical wedge, with a first cone half-angle, comprising a central portion and an annular portion;

a second optical wedge, with a second cone half-angle, comprising a central portion and an annular portion;

wherein phases of the central portions of the first and the second optical wedges are advanced relative to phases of the annular portions of the first and the second optical wedges, respectively; and

means for counter-rotating the first and the second optical wedges whereby rotation of one of the optical wedges is in one direction while rotation of the other optical wedge is in the opposite direction and with a fixed phase offset $\Delta\varphi$; and

an array of two-dimensional pixellated detectors for detecting the second beam of light received from the scanning means and generating signals responsive to the light; and

a processor system for processing signals from the detectors.

19. A method of imaging a contiguous map of ground from an aircraft or a spacecraft comprising:

providing a laser beam;

scanning the laser beam transmitted to surface of the ground;

scanning the laser beam received from the surface of the ground;

wherein transmission scanning of field of view of the surface is ahead of reception scanning of field of view of the surface;

detecting the laser beam returned from the surface of the ground; and

processing signals responsive to the returned beam.

20. The method of imaging in claim 19, wherein the laser beam is pumped by diode laser arrays operating in CW mode and passively Q-switched by a saturable absorber.

21. The method of imaging in claim 19, wherein the step of scanning the transmission beam and the step of the scanning the reception beam are effected by a dual wedge scanner comprising:

a first optical wedge, with a first cone half-angle, comprising a central portion and an annular portion;

a second optical wedge, with a second cone half-angle, comprising a central portion and an annular portion;

wherein phases of the central portions of the first and the second optical wedges are advanced relative to phases of the annular portions of the first and the second optical wedges, respectively; and

counter-rotating the first and the second optical wedges whereby rotation of one of the optical wedges is in one direction while rotation of the other optical wedge is in the opposite direction.

22. The method of imaging in claim 21, wherein the instantaneous position of the receiver field of view on the surface at time t is determined by the following equations:

$$x(t) = v_g t + R \tan\alpha[\cos\omega t + \cos(-\omega t + \Delta\varphi)]$$
$$y(t) = R \tan\alpha[\sin\omega t + \sin(-\omega t + \Delta\varphi)]$$

wherein v_g is the ground velocity an aircraft or a spacecraft in the positive x-direction; ω is the angular velocity of the counter-rotating optical wedges; α is the cone half-angle of optical wedges; R is the perpendicular distance from the scanner to the surface; and $\Delta\varphi$ is the relative starting phase of the optical wedges.

23. The method of imaging in claim 21, wherein the means for counter-rotating the first and second optical wedges comprises in combination:

a first annular bevel gear connected relative to the first optical wedge;

a second annular bevel gear connected relative to the second optical wedge;

a bevel miter gear rotatably journaled between the first annular bevel gear and the second annular bevel gear for engagement therewith;

motor means; and

means for operatively connecting said motor means to the first optical wedge, the second optical wedge or the bevel miter gear whereby rotation of one of the wedges in one direction will rotate the other of the wedges in the opposite direction.

24. The method of imaging in claim 19, further comprising:

angularly displacing the laser beam in the forward direction of the motion of an aircraft or a spacecraft prior to the step of scanning the laser beam transmitted to surface.

25. The method of imaging in claim 24, wherein the step of angularly displacing the laser beam is effected by passing the beam through a prism or a mirror.

26. The method of imaging in claim 19, wherein the step of detecting the returned laser beam comprises:

counting photons returned from the surface; and

generating signals responsive to the number of the returned photons.

27. The method of imaging in claim 19, wherein the step of detecting the returned laser beam is effected by a two-dimensional array of pixellated detectors and a multi-channel timing receiver wherein the number of channels is equal to the number of pixels of the array detectors.

28. The method of imaging in claim 19, wherein the step of comprises:

producing a ranging signal responsive to the returned beam.